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AN EVALUATION OF A SOIL FUMIGATION TREATMENT FOR CONTROLLING CYLINDROCLADIUM ROOT ROT IN A FOREST NURSERY

U.S. Forest Service
Asheville, North Carolina

U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
SOUTHEASTERN AREA, STATE AND PRIVATE FORESTRY
DIVISION OF FOREST PEST CONTROL

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AN EVALUATION OF A SOIL FUMIGATION TREATMENT FOR CONTROLLING CYLINDROCLADIUM ROOT ROT IN A FOREST NURSERY

By

Charles E. Affeltranger

U.S. Forest Service
Asheville, North Carolina

ABSTRACT

Soil at the Ralph Edwards State Forest Nursery at Morganton, North Carolina was fumigated with MC-33 (methyl bromide-67% and chloropicrin - 33%) at 300 pounds per acre to control Cylindrocladium root rot. A portion of the infested soil was not treated. In two soil bioassays with alfalfa as an indicator, a low incidence of *Cylindrocladium scoparium* was found in the fumigated portion. The fungus was readily isolated from alfalfa grown in the non-fumigated soil. No sporulation was present on seedlings grown on fumigated soil. Sporulation of the fungus on alfalfa cotyledons did occur when seedlings were grown on the non-fumigated soil. In addition yellow-poplar residues from the fumigated soil failed to yeild the fungus while one culture was obtained from the non-fumigated soil.

INTRODUCTION

In the late Summer and Fall of 1968, 250,000 yellow-poplar 1-0 stock were lost to root rot in the Ralph Edwards State Forest Nursery at Morganton, North Carolina. Technical assistance from pathologists

in the Division of Forest Pest Control at Asheville was requested. Laboratory diagnosis revealed the causal agent to be *Cylindrocladium scoparium*, Morgan. Twenty-six of the 27 beds so affected were then fumigated with MC-33 (methyl bromide - 67% and chloropicrin - 33%) at the rate of 300 pounds per acre. The remaining bed was not treated (Cordell, *et al.*, 1969).

These 27 beds were then sampled for *C. scoparium* utilizing alfalfa as an indicator. The objective of this bioassay was to determine the relative incidence of the fungus in the treated and non-treated beds.

METHODS

Isolation techniques for *C. scoparium* were modified from that outlined by Thies and Patton (1966). The steps are as follows:

1. Suspect soil was placed in the depressions of muffin pans.

2. "Vernal" alfalfa was planted in the depressions.

3. The soil was watered every 24 hours with sterile distilled water.

4. Seedlings were grown for 5 - 19 days at room temperature.

5. Alfalfa roots were dipped in one percent clorox for 45 seconds and placed on two percent malt extract agar for ten days or longer.

6. The cultures were then examined for *C. scoparium*.

Under conditions of high humidity, the fungus sporulates on alfalfa. In this study *C. scoparium* appeared on the cotyledons (Fig. 1). The high humidity condition was facilitated by the use of a plastic covering over the muffin pans.

In addition to the bioassay, residual yellow-poplar roots were cultured from the root rot area. Two percent malt extract agar was again used.

C. scoparium is readily recognized macroscopically in culture by the formation of dark reddish brown microsclerotia. No microscopical examination is necessary for identification.

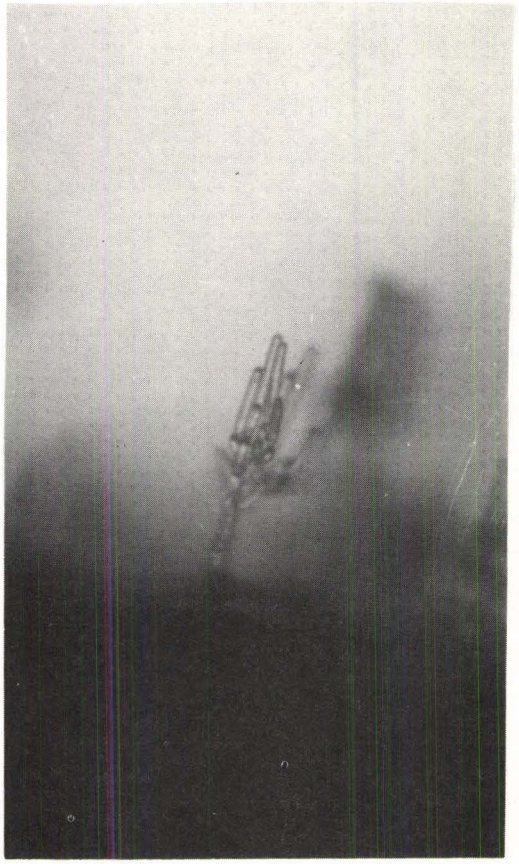

Fig. 1 Photomicrograph of C. scoparium sporulating on cotyledon of alfalfa. Note - long cylindrical spores characteristic of Cylindrocladium spp. (60X)

RESULTS

Two separate tests were conducted. No attempt was made to assay non-fumigated soil in the second test as the presence of *C. scoparium* had been well established in the first. Table 1 summarizes the cultural results for Test 1.

Table 1 Incidence of C. scoparium isolated from Alfalfa Grown in Fumigated and Non-fumigated soil from Compartment E at the Ralph Edwards State Forest Nursery in Morganton, North Carolina - Test 1.

Location of Soil	Age of Alfalfa Seedlings - Days	Number of Cultures made		Presence (+) or absence (-) of C. scoparium	
Section 15 (fumigated)	5	3	6	-	
	12	3		-	
Section 16 (fumigated)	5	3	6	-	
	12	3		-	
Section 17 (fumigated)	5	2	5	-	
	12	3		-	
TOTAL	-		17	0	
Section 17, last bed (Non-fumigated)	5		3	+ (3)	(6)
	12		3	+ (3)	

Since the fungus was not detected in the fumigated soil from the first test, a second test was conducted to determine if the fungus had been missed (Table 2). The 100% recovery of *C. scoparium* from alfalfa growing on non-fumigated soil firmly established the presence of the fungus in

the untreated bed of Section 17. Also, *C. scoparium* sporulated on alfalfa grown on this soil after 17 days while no sporulation was detected on alfalfa seedlings grown on fumigated soil after 19 days.

Table 2 Incidence of C. scoparium Isolated from Alfalfa Grown on Fumigated Soil from Compartment E at the Edwards Nursery - Test 2.

Location of Soil	Age of Alfalfa Seedlings - Days	Number of Cultures made		Presence (+) or absence (-) of C. scoparium
Section 15	5	12	24	-
	9	12		-
Section 16	5	9	18	-
	9	9		-
Section 17	5	9	18	+ (1) (2)
	9	9		+ (1)
TOTAL	-		60	

C. scoparium was recovered in only two of the 77 cultures taken from seedlings grown on fumigated soil in the two tests, indicating a low incidence of the fungus in the treated beds. No sporulation was found on seedlings grown on treated soil in either of the two tests.

The results of cultures made from residual yellow-poplar roots obtained from the treated and non-treated beds substantiates the above results (Table 3).

Table 3 Incidence of C. scoparium Isolated from Yellow-poplar Root Residues in Fumigated and Non-fumigated soil from Compartment E at the Edwards Nursery.

Section	Plates	Presence (+) or Absence (-) of C. scoparium
15 (fumigated)	5	-
16 (fumigated)	5	-
17 (fumigated)	4	-
17 (non-fumigated bed)	5	+ (1)

DISCUSSION

Soil fumigation with MC-33 obviously reduced the incidence of *C. scoparium* significantly. However, this fungus can penetrate to depths of a foot or more in nursery soils (Anderson, 1918). Since the fumigant was injected at an average depth of nine inches, the incidence of the fungus could still be relatively high below this depth.

Alfalfa appears to be an efficient indicator of *C. scoparium*. It is hoped that this legume will be equally efficient in the field. If so, it should be possible to demonstrate the usefulness of alfalfa to nursery personnel as a bioindicator of cylindrocladium root rot in problem areas. The use of the plant as a bioassay for field soil in the laboratory is well documented (Bugbee, 1962 ; Thies and Patton, 1966). Sporulation on alfalfa can be detected and identified by a 20X hand lens.

The eradication or elimination of a root rot fungus such as *C. scoparium* is virtually impossible. The test results show, however, that the incidence

of the fungus in the treated beds has been significantly reduced and that further soil treatment, except for the untreated bed in Section 17, may only be a precautionary measure. The very low incidence of the fungus detected in the fumigated soil with the bioassay technique is supported by the lack of sporulation on the alfalfa seedlings grown on the treated soil and the negative cultures obtained from the corresponding residual yellow-poplar roots. Evidence of a high incidence of *C. scoparium* in the non-fumigated soil is strengthened further by the presence of fungus sporulation on the alfalfa seedling cotyledons along with the isolation of the fungus from the yellow-poplar root residues.

RECOMMENDATIONS

1. Based on the results of this evaluation, MC-33 used at 300 pounds per acre would appear to give adequate control of cylindrocladium root rot. The area involved in this evaluation will be tested further in the future.

REFERENCES

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Thies, W.G. and R.F. Patton. 1966. Spot-plate technique for the bioassay of Cylindrocladium scoparium. Phytopathology 56 : 1116-17.

More detailed information can be obtained by writing to the Forest Pest Control Division Field Offices listed below or to the Atlanta Office.

FIELD OFFICES	FOR STATES OF
Asheville Office Amel E. Landgraf, Supervisor Division of Forest Pest Control SA, State & Private Forestry, U.S.F.S. Post Office Box 5895 Asheville, North Carolina 28803 Phone: (704) 254-0961 Ext. 625	Florida Georgia Kentucky North Carolina South Carolina Tennessee Virginia
Alexandria Office William M. Ciesla, Supervisor Division of Forest Pest Control SA, State & Private Forestry, U.S.F.S. 2500 Shreveport Highway Pineville, Louisiana 71360 Phone: (318) 445-6511 Ext. 311	Alabama Arkansas Louisiana Mississippi Oklahoma Texas

AREA OFFICE

Russell K. Smith
Assistant Area Director
Division of Forest Pest Control
50 Seventh Street, N. E.
Atlanta, Georgia 30323

Phone: (404) 526-5189